## CLAIMS

What is claimed is:

1. A sensor comprised of a sensor element comprising one or more sensing moieties and one or more signaling moieties, wherein each sensing moieties has one or more states indicative of a target analyte, one or more signaling moieties alone or in combination engenders the production of a detectable signal, the state or a change in the state of one or more sensing moieties is transduced to one or more signaling moieties whereby one or more of the signaling entities alone or in combination engender production of a detectable signal qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or the amount of a target analyte or of a change in the absence below a threshold, the presence above a threshold or the amount of a target analyte, and one or the other or both the sensing moiety and the signaling moiety is not a naturally occurring entity.

2. A sensor according to claim 1, wherein one or more sensing moieties binds one or more target analytes indirectly but not directly.

3. A sensor according to claim 1, wherein one or more sensing moieties is comprised in a sensing module and one or more signaling moieties is comprised in a signaling module, wherein the sensing module can be operatively linked to different signaling modules and the signaling molecule can be operatively linked to different sensing modules.

4. A sensor according to claim 1, wherein production of the detectable signal engenders changes in the sensor element whereby production of the detectable signal is terminated and a change in binding of the one or more target analytes to one or more sensing moieties is required to again engender production of a detectable signal.

5. A sensor according to claim 1, comprising a first plurality of sensing moieties that directly or indirectly bind a first target analyte and a second plurality of sensing moieties that directly or indirectly bind a second target analyte, further comprising one or more first signaling moieties that engender production of a first detectable signal and one or more second signaling moieties that engender production of a second detectable

signal distinguishable from the first detectable signal, wherein the first detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold, or the amount of the first target analyte or of a change in the absence below a threshold, the presence above a threshold, or the amount of the first target analyte, and the second detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold, or the amount of the second target analyte or of a change in the absence below a threshold, the presence above a threshold, or the amount of the second target analyte.

6. A sensor according to claim 1, comprising a first plurality of first sensing moieties that directly or indirectly bind a first target analyte, a second plurality of second sensing moieties that directly or indirectly bind a second target analyte, and one or more signaling moieties that alone or in combination engender the production of a detectable signal, wherein production of the detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or the amount of the first and the second target analytes in combination or is indicative of a change in the absence below a threshold, the presence above a threshold or the amount of the first and second target analytes in combination.

7. A sensor according to claim 6, wherein the first and second target analytes contribute differently to the combination.

8. A sensor according to claim 1, wherein one or more of the sensing moieties is partly or entirely *de novo*.

9. A sensor according to claim 1, wherein one or more sensing moieties are partly or entirely the products of *in vitro* selection or directed evolution.

10. A sensor according to claim 1, wherein the state of one or more sensing moieties is transduced to one or more signaling entities, wherein the sensing moieties and the signaling moieties are in different molecules or multimolecular complexes.

11. A sensor comprised of sensor element comprising a first plurality of sensing moieties and a second plurality of signaling moieties, wherein each sensing moiety has one or more states indicative of a target analyte, the state or a change in the state of one or more of the sensing moieties is transduced to one or more of signaling moieties, one signaling

moiety alone or a third plurality of signaling moieties in combination engenders the production of a detectable signal qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or the amount of a target analyte or of a change in the absence below a threshold, the presence above a threshold or the amount of a target analyte, wherein the sensing moiety and the signaling moiety do not naturally occur with one another in the same organism.

12. A sensor according to claim 11, wherein one or more sensing moieties binds one or more target analytes indirectly but not directly.

13. A sensor according to claim 11, wherein one or more sensing moieties is comprised in a sensing module and one or more signaling moieties is comprised in a signaling module, wherein the sensing module can be operatively linked to different signaling modules and the signaling molecule can be operatively linked to different sensing modules.

14. A sensor according to claim 11, wherein production of the detectable signal engenders changes in the sensor element whereby production of the detectable signal is terminated and a change in binding of the one or more target analytes to one or more sensing moieties is required to again engender production of a detectable signal.

15. A sensor according to claim 11, comprising a first plurality of sensing moieties that directly or indirectly bind a first target analyte and a second plurality of sensing moieties that directly or indirectly bind a second target analyte, further comprising one or more first signaling moieties that engender a first detectable signal and one or more second signaling moieties that engender a second detectable signal distinguishable from the first detectable signal, wherein the first detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold, or the amount of the first target analyte or of a change in the absence below a threshold, the presence above a threshold, or the amount of the first target analyte and the second detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold, or the amount of the second target analyte or of a change in the absence below a threshold, the presence above a threshold, or the amount of the second target analyte.

16. A sensor according to claim 11, comprising a first plurality of first sensing moieties that directly or indirectly bind a first target analyte, a second plurality of second sensing moieties that directly or indirectly bind to a second target analyte, and one or more signaling moieties that engender the production of a detectable signal, wherein production of the detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or the amount of the first and the second target analytes in combination or is indicative of a change in the absence below a threshold, the presence above a threshold or the amount of the first and second target analytes in combination.

17. A sensor according to claim 16, wherein the first and second target analytes contribute differently to the combination.

18. A sensor according to claim 11, wherein the sensing moiety is derived from the antigen binding site of an antibody, the binding site of a bacterial chemosensory receptor, or the ligand-binding site of a ligand binding receptor.

19. A sensor according to claim 11, wherein one or more sensing moieties are partly or entirely the products of *in vitro* selection or directed evolution.

20. A sensor according to claim 11, wherein the state of one or more sensing moieties is transduced to one or more signaling entities, wherein the sensing moieties and the signaling moieties are in different molecules or multimolecular complexes.

21. A sensor comprised of sensor element comprising a first plurality of sensing moieties and a second plurality of signaling moieties, wherein each sensing moiety has one or more states indicative of a target analyte, the state or a change in the state of one or more of the sensing moieties is transduced to one or more of signaling moieties, one signaling moiety alone or a third plurality of signaling moieties in combination engenders the production of a detectable signal qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or the amount of a target analyte, or of a change in the absence below a threshold, the presence above a threshold or the amount of a target analyte, wherein the sensing moieties are comprised of one or more polypeptides, and one or more regions of the one or more polypeptides has a *de novo* polypeptide sequence.

22. A sensor according to claim 21, wherein one or more sensing moieties binds one or more target analytes indirectly but not directly.

23. A sensor according to claim 21, wherein one or more sensing moieties is comprised in a sensing module and one or more signaling moieties is comprised in a signaling module, wherein the sensing module can be operatively linked to different signaling modules and the signaling molecule can be operatively linked to different sensing modules.

24. A sensor according to claim 21, wherein production of the detectable signal engenders changes in the sensor element whereby production of the detectable signal is terminated and a change in binding of the one or more target analytes to one or more sensing moieties is required to again engender production of a detectable signal.

25. A sensor according to claim 21, comprising a first plurality of sensing moieties that directly or indirectly bind a first target analyte and a second plurality of sensing moieties that directly or indirectly bind a second target analyte, further comprising one or more first signaling moieties that alone or in combination engender the production of a first detectable signal and one or more second signaling moieties that alone or in combination engender the production of a second detectable signal distinguishable from the first detectable signal, wherein the first detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold, or the amount of the first target analyte or of a change in the absence below a threshold, the presence above a threshold or the amount of the first target analyte and the second detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold, or the amount of the second target analyte or of a change in the absence below a threshold, the presence above a threshold, or the amount of the second target analyte.

26. A sensor according to claim 21, comprising a first plurality of first sensing moieties that directly or indirectly bind a first target analyte, a second plurality of second sensing moieties that directly or indirectly bind to a second target analyte, and one or more signaling moieties that engender the production of a detectable signal, wherein production of the detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or the amount of the first and the second target

analytes in combination or is indicative of a change in the absence below a threshold, the presence above a threshold or the amount of the first and second target analytes in combination.

27. A sensor according to claim 26, wherein the first and second target analytes contribute differently to the combination.

28. A sensor according to claim 21, wherein the sensing moiety is derived partly or entirely from the antigen binding site of an antibody, the binding site of a bacterial chemosensory receptor, or the ligand-binding site of a ligand binding receptor.

29. A sensor according to claim 21, wherein one or more sensing moieties are partly or entirely the products of *in vitro* selection or directed evolution.

30. A sensor according to claim 21, wherein the state of one or more sensing moieties is transduced to one or more signaling entities, wherein the sensing moieties and the signaling moieties are in different molecules or multimolecular complexes.

31. A sensor according to claim 21, wherein said *de novo* polypeptide sequence is a *de novo* designed binary patterned sequence.

32. A sensor according to claim 21, wherein the sensing moiety comprises a four helix bundle receptor protein binding domain.

33. A sensor according to claim 29, wherein the sensing moiety comprises a four helix bundle receptor protein binding domain.

34. A sensor according to claim 30, wherein the sensing moiety comprises a four helix bundle receptor protein binding domain.

35. A sensor according to claim 21, wherein the sensing moieties and the signaling moieties are disposed operationally in a membrane.

36. A sensor according to claim 21, wherein the sensor element is comprised in cell.

37. A sensor according to claim 36, wherein the cell is a bacterial cell.

38. A sensor according to claim 37, wherein the bacterial cell is a chemosensory cell.

39. A sensor according to claim 38, wherein the chemosensory cell comprises methyaccepting chemosensory receptors.

40. A sensor according to claim 21, wherein the *de novo* polypeptide sequence is comprised in the ligand binding domain of a bacterial methyaccepting chemosensory receptor.

41. A sensor according to claim 40, wherein the signaling moiety is a signaling domain of a methyaccepting chemoreceptor.

42. A sensor according to claim 40, wherein a *de novo* polypeptide sequence is a *de novo* designed binary patterned sequence.

43. A sensor according to claim 40, wherein a one or more polypeptides comprises a region that is product of *in vitro* selection or directed evolution or both of a polypeptide comprising a region of *de novo* polypeptide sequence.

44. A sensor according to claim 43, wherein the *de novo* polypeptide sequence is the product of directed evolution of a *de novo* designed binary patterned sequence..

45. A sensor according to claim 40, wherein one or more sensing moieties binds one or more target analytes indirectly but not directly.

46. A sensor according to claim 40, wherein one or more sensing moieties is comprised in a sensing module and one or more signaling moieties is comprised in a signaling module, wherein the sensing module can be operatively linked to different signaling modules and the signaling molecule can be operatively linked to different sensing modules.

47. A sensor according to claim 40, wherein production of the detectable signal engenders changes in the sensor element whereby production of the detectable signal is terminated and a change in binding of the one or more target analytes to one or more sensing moieties is required to again engender production of a detectable signal.

48. A sensor according to claim 40, comprising a first plurality of sensing moieties that directly or indirectly bind a first target analyte and a second plurality of sensing moieties that directly or indirectly bind a second target analyte, further comprising one or more first signaling moieties that engender a first detectable signal and one or more second signaling moieties that engender a second detectable signal distinguishable from the first detectable signal, wherein the first detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold, or the amount of the first target analyte or of a change in the absence below a threshold, the presence above a threshold or the amount of the first target analyte and the second detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold, or the amount of the second target analyte or of a change in the absence below a threshold, the presence above a threshold, or the amount of the second target analyte.

49. A sensor according to claim 40, comprising a first plurality of first sensing moieties that directly or indirectly bind a first target analyte, a second plurality of second sensing moieties that directly or indirectly bind to a second target analyte, and one or more signaling moieties that engender the production of a detectable signal, wherein production of the detectable signal is qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or the amount of the first and the second target analytes in combination or is indicative of a change in the absence below a threshold, the presence above a threshold or the amount of the first and second target analytes in combination.

50. A sensor according to claim 49, wherein the first and second target analytes contribute differently to the combination.

51. A sensor according to claim 21, wherein the sensing moiety is derived partly or entirely from the antigen binding site of an antibody, the binding site of a bacterial chemosensory receptor, or the ligand-binding site of a ligand binding receptor.

52. A sensor according to claim 21, wherein one or more sensing moieties are partly or entirely the products of *in vitro* selection or directed evolution.

53. A sensor according to claim 21, wherein the state of one or more sensing moieties is transduced to one or more signaling entities, wherein the sensing moieties and the signaling moieties are in different molecules or multimolecular complexes.

54. A sensor according to claim 1, wherein the detectable signal is fluorescence, chemiluminescence, phosphorescence or optical absorbence, or a change in fluorescence, chemiluminescence, phosphorescence or optical absorbence.

55. A sensor according to claim 11, wherein the detectable signal is fluorescence, chemiluminescence, phosphorescence or optical absorbence. or a change in fluorescence, chemiluminescence, phosphorescence or optical absorbence.

56. A sensor according to claim 21, wherein the detectable signal is fluorescence, chemiluminescence, phosphorescence or optical absorbence. or a change in fluorescence, chemiluminescence, phosphorescence or optical absorbence.

57. A sensor according to claim 40, wherein the detectable signal is fluorescence, chemiluminescence, phosphorescence or optical absorbence. or a change in fluorescence, chemiluminescence, phosphorescence or optical absorbence.

58. A sensor according to claim 57, wherein the detectable signal is a change in the fluorescence intensity of an acceptor fluorophore of a donor-acceptor fluorescence energy transfer pair.

59. A method for detecting a target analyte comprising exposing a composition in which the target analyte is to be detected to a sensor that produces a detectable signal indicative of the absence below a threshold, the presence above a threshold, the amount or a change in the absence below a threshold, the presence above a threshold or the amount of the target analyte, and determining the detectable signal or the absence thereof, wherein the sensor is comprised of a sensor element comprising one or more sensing moieties and one or more signaling moieties, wherein each sensing moieties has one or more states indicative of a target analyte, each signaling moiety alone or in combination engenders the production of a detectable signal, the state or a change in the state of one or more signaling moieties is transduced to one or more signaling moieties whereby the one or more signaling entities alone or in combination engender the production of a detectable signal qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or

the amount of a target analyte or of a change in the absence below a threshold, the presence above a threshold or the amount of a target analyte, and one or the other or both the sensing moiety and the signaling moiety is not a naturally occurring entity.

60. A method for detecting a target analyte comprising exposing a composition in which the target analyte is to be detected to a sensor that produces a detectable signal indicative of the absence below a threshold, the presence above a threshold or the amount, or a change in the absence below a threshold, the presence above a threshold or the amount of the target analyte, and determining the detectable signal or the absence thereof, wherein the sensor is comprised of a sensor element comprising one or more sensing moieties and one or more signaling moieties, wherein each sensing moieties has one or more states indicative of a target analyte, each signaling moiety alone or in combination engenders the production of a detectable signal, the state or a change in the state of one or more signaling moieties is transduced to one or more signaling moieties whereby the one or more signaling entities alone or in combination engender the production of a detectable signal qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or the amount of a target analyte or of a change in the absence below a threshold, the presence above a threshold or the amount of a target analyte, wherein the sensing moieties are comprised of one or more polypeptides, and one or more regions of one or more of the polypeptides has a *de novo* polypeptide sequence.

61. A bacterial cell comprising a first plurality of sensing moieties and a second plurality of signaling moieties, wherein each sensing moiety has one or more states indicative of a target analyte, the state or a change in the state of one or more of the signaling moieties is transduced to one or more of signaling moieties, one signaling moiety alone or a third plurality of signaling moieties in combination engenders the production of a detectable signal qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or the amount of a target analyte, or of a change in the absence below a threshold, the presence above a threshold or the amount of a target analyte, wherein the sensing moieties are comprised of one or more polypeptides, and one or more regions of the polypeptides has a *de novo* polypeptide sequence.

62. A method for making a sensor, comprising preparing sensor elements from a bacterial cells culture and incorporating said sensor elements operatively into a sensor,

wherein the sensor elements comprise a first plurality of sensing moieties and a second plurality of signaling moieties, wherein each sensing moiety has one or more states indicative of a target analyte, the state or a change in the state of one or more of the signaling moieties is transduced to one or more of signaling moieties, one signaling moiety alone or a third plurality of signaling moieties in combination engenders the production of a detectable signal qualitatively or quantitatively indicative of the absence below a threshold, the presence above a threshold or the amount of a target analyte, or of a change in the absence below a threshold, the presence above a threshold or the amount of a target analyte, wherein one or more sensing moieties is comprised of one or more polypeptides, and one or more regions of one or more of the polypeptides has a *de novo* polypeptide sequence.